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(54) METHOD AND DEVICE FOR FILLING A CASING WITH PARTICULATE MATTER

(71) I, KARL ERIC HESSELGREN, a Swedish subject, of Stortloppsvagen 8 C, S-633 57 Eskilstuna, Sweden, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method of filling a casing of the type having an entrance opening which is small in relation to the cross-sectional area of the casing with particulate matter and to a device for use in carrying out the method. The particulate matter may be granular (powder or larger grains) or flaky or may comprise a mixture of said forms and may be obtained by disintegration or granulation.

The invention is particularly useful for filling a shell casing with solid explosive whereby the explosive is compressed within the casing.

One aspect of the invention provides a method of filling a casing of the type having an entrance opening which is small in relation to the cross-sectional area of said casing with particulate matter comprising inserting an elastic bag into the interior of the casing through the entrance opening before or after introduction of the particulate matter therein, tightly closing the entrance opening, connecting said casing to a vacuum-source, removing air from the interior of said casing and supplying said bag with a pressure medium to expand the bag so as to compress the particulate matter contained within the casing into close contact with the surrounding walls of the casing.

Another aspect of the invention provides a device for use in carrying out the method as defined in the immediately preceding paragraph, the device comprising an elastic bag attached to one end of a sealing means which means is insertable into the entrance opening of a casing tightly to close the opening, said sealing means being provided with a first passageway to communicate the interior of said casing with a vacuum-source via a closable conduit, and a second passageway to communicate said bag with a source of fluid pressure.

Some advantages of the method and device of the present invention are that a more uniform density of explosive is obtained within the casing and that contraction clearances and the risk of cavities and cracks are reduced. Automated production of shells is carried out in a protected room (bunker), and only about 4–5 shells are used at the same time, arranged in such a way that if a shell should detonate, the shell does not cause detonation of adjacent shells. All work can be done without the explosive being melted. Among the advantages is that no cutting operation is required for the formation of the fuse site or the like, as is the case when melted explosive is being cast, since such a site can be pressed. The method allows different kinds of explosives to be pressed directly into the shell into a special form, e.g. lenses for the shaping of the detonation wave.

The method and the device are also useful for the preparation of different kinds of charges of powder, even those provided with inner cavities, and by variations in shape of the elastic bag the inner surface of the charge may be shaped in different ways so that appropriate combustion is obtained. The pressing of charges of powder may be performed in several steps using different kinds of powder, so that the charge becomes stratified, making still greater variation of the powder combustion speed easily obtainable. If the powder is mixed with a binder, the method allows a greater freedom at the choice of binder, so that a considerable constructional freedom is obtained.

The method and the device also allows discs of, for instance, inert materials to be

pressed between the powders, if this is required from strength or powder technical reasons.

Two embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figures 1 to 4 are longitudinal, axial, sectional views of a high-explosive shell being filled with an explosive according to the method of invention, showing four successive phases and,

Figure 5 is a longitudinal, axial sectional view of a high-explosive shell being filled with an explosive according to another embodiment of the invention.

Referring to the drawings, a cold or warm shell casing 1 is filled according to Figure 5 with a finely divided, solid explosive which can be cold or warm. An elastic bag 2 made of rubber or plastic material is then inserted through the entrance opening of the shell casing. The entrance opening is thereafter closed with a sealing means 3, the bag 2 being attached to a lower part of said sealing means. The sealing means 3 is provided with a passageway 4, communicating with the bag 2, and a passageway 5, communicating the interior of the shell casing with a vacuum-source for the removal of air from the cavity. The sealing means 3 is at its lower end extended with a tube 6 which tube is closed at the bottom, the bag 2 being threaded on to surround tube 6. The peripheral surface of said tube 6 is provided with a number of evenly distributed, small apertures. Tube 6 is not necessary, as is shown in the embodiment of Figures 1 to 4, but gives the advantage that the bag being threaded on the tube is able to penetrate into the explosive, which allows the shell casing to be filled almost completely before the explosive is compressed. The compression of the explosive is carried out after evacuation of air from the cavity of the shell casing, the bag 2 being supplied with a pressure medium via channel 4 of such a pressure that the bag is expanded so as to act on the explosive with sufficient pressure to give the desired compression (Figure 2). Channel 4 normally is provided with a valve operable to shut-off the supply of pressure medium to the bag. The procedure can be repeated a number of times with a smaller bag employed each time (cf. Figures 1 and 3), until the shell casing is filled with compressed explosive to the extent intended. Still more explosive is then added, and a site for the fuse is pressed into the explosive by means of a suitably shaped mandrel in a hydraulic press.

Instead of the tube 6 a device may be attached to the sealing means 3, which device may be a stiff helical spring or screw spring, which spring is surrounded by the bag. The bag can thereby penetrate into the uncompressed explosive. Alternatively the sealing means 3, can be provided with still another passageway channel, through which channel the explosive is introducel. The bag 2 is, in such a case, first inserted into the shell casing, and then the casing is filled with explosive around the bag.

At the pressing of charges with inner cavities, the tube 6 or the corresponding "screw spring" also gives the advantage that the bag will become centered so as to make the charge symmetric so as to provide an all around uniform density explosive after the compression (compacting).

WHAT I CLAIM IS:—

1. A method of filling a casing of the type having an entrance opening which is small in relation to the cross-sectional area of said casing with particulate matter comprising inserting an elastic bag into the interior of the casing through the entrance opening before or after introduction of the particulate matter therein, tightly closing the entrance opening, connecting said casing to a vacuum-source, removing air from the interior of said casing and supplying said bag with a pressure medium to expand the bag so as to compress the particulate matter contained within the casing into close contact with the surrounding walls of the casing.

2. A method as claimed in claim 1, wherein the introduction and the compression of the particulate matter is performed in a series of filling steps a smaller bag being employed for each step.

3. A device for use in carrying out the method as claimed in claim 1 or claim 2, the device comprising an elastic bag attached to one end of a sealing means which means is insertable into the entrance opening of a casing tightly to close the opening, said sealing means being provided with a first passageway to communicate the interior of said casing with a vacuum-source via a closable conduit, and a second passageway to communicate said bag with a source of fluid pressure.

4. A device as claimed in claim 3 wherein the second passageway is provided with means to prevent the supply of fluid pressure to the bag.

5. A device as claimed in claim 3 or claim 4, wherein said one end of the sealing means is provided with an extension which extension is surrounded by the bag the extension being so constructed as to permit fluid pressure to enter the bag.

6. A device as claimed in claim 5 wherein the extension comprises a tube closed at its end remote from the sealing means and having a plurality of apertures provided in its peripheral surface.

7. A method of filling a casing with particulate matter substantially as hereinbefore described with reference to and as

shown in Figures 1 to 4 or Figure 5 of the accompanying drawings.

8. A device for use in filling a casing with particulate matter substantially as hereinbefore described with reference to and as shown in Figures 1 to 4 or Figure 5 of the accompanying drawings.

KARL ERIC HESSELGREN
Per BOULT, WADE & TENNANT
34 Cursitor Street, London, EC4A 1PQ
Chartered Patent Agents

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

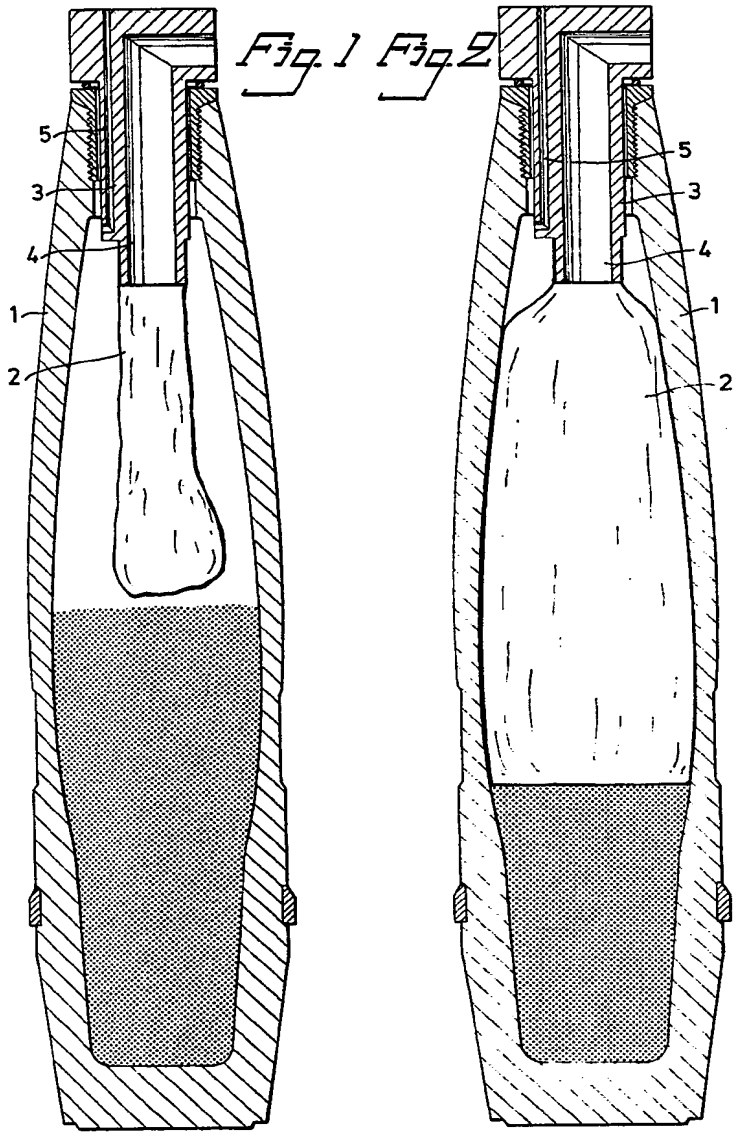
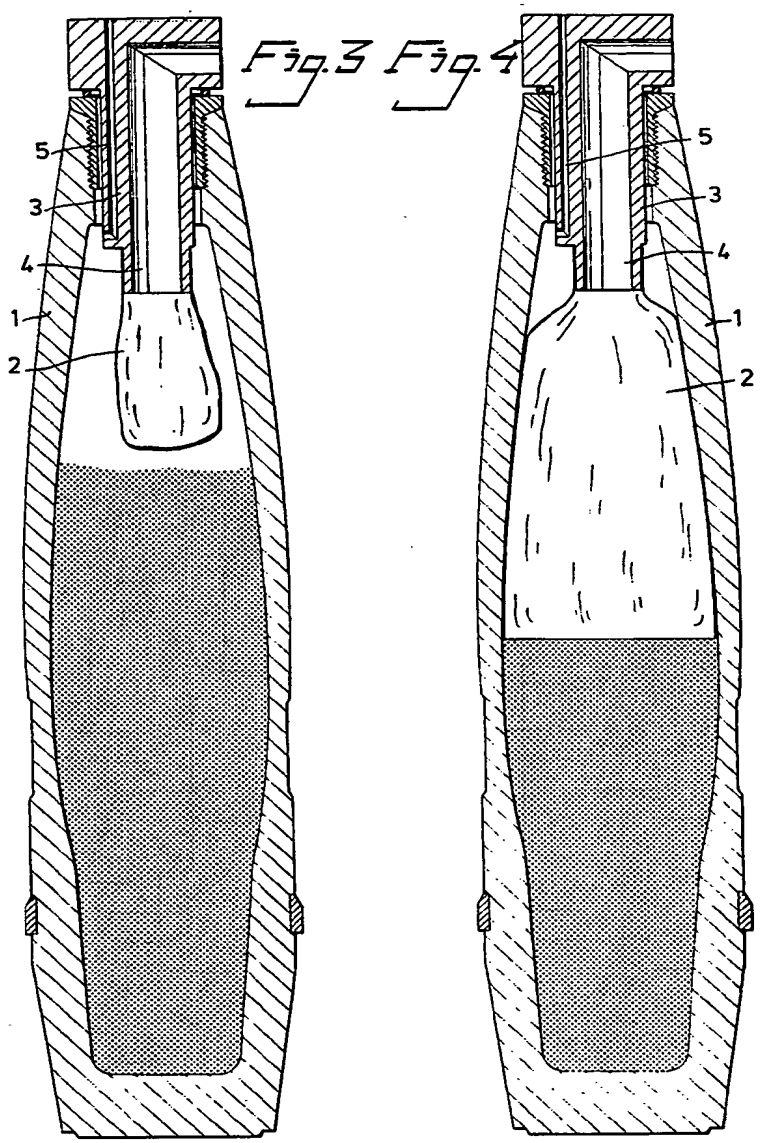


Fig.3 Fig.4



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Sheet 3

Fig. 5